How Does E-Commerce Policy Affect Consumption Disparities of Rural Households?- Evidence from China

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Abstract: *In the context of China's ongoing efforts to promote countryside revitalization and facilitate domestic economic circulation, it is of great significance to reduce the consumption disparity among rural households and unleash the consumption potential in the countryside. Based on data from China Family Panel Studies, this paper adopts a staggered difference-in-differences method to assess the impact of the e-commerce to enter rural areas on the consumption disparity among rural households. Findings: the comprehensive demonstration work of promoting e-commerce to enter rural areas has reduced the consumption disparity among rural households through the following mechanisms. Firstly, this policy initiative has mitigated the consumption-inhibiting effect on rural household consumption due to the local market size and external market accessibility by promoting the distribution of consumer goods to villages. Secondly, this policy initiative has also increased the agricultural income of rural households and reduced their consumption disparity by distributing farm produce to cities and enhancing the agricultural income of rural households. Moreover, the work is characterized by inclusive growth and is not susceptible to the "elite capture" phenomenon.*

Keywords: *E-commerce to enter rural areas, consumption disparity among rural household, market accessibility, market size, income of rural households*

JEL Classification Codes: O55, D63
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1. Introduction

The Report to the 20th CPC National Congress has reaffirmed the importance of increasing domestic consumption and strengthening the fundamental role of consumption in driving economic development[1]. As a result of the Chinese government's efforts to develop a complete domestic consumption system, final consumption has contributed a steadily increasing share to China's economic growth over the years. In 2020, rural population of 509.79 million accounted for 36% of China's total population and displayed significant market potential[2]. Despite the rising per capita disposable income and the narrowing income disparities among rural households, their consumption disparity has steadily increased over the years (Li and Cai, 2023). Identifying the causes of such widening consumption disparity will assist policymakers

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[1] Xi Jinping. Hold High the Great Banner of Socialism with Chinese Characteristics and Strive in Unity to Build a Modern Socialist Country in All Respects - Report to the 20th National Congress of the Communist Party of China. Beijing: People's Publishing House, 2022, page 29.
[2] Main Data of the Seventh National Population Census, https://www.stats.gov.cn/sj/zxfb/202302/t20230203_1901080.html.

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in achieving a balanced improvement in the consumption level among rural households, which is crucial for unleashing rural household consumption potential, expanding domestic consumption, and fostering domestic economic circulation.

Digital technologies have an enabling effect on high-quality rural development, and are instrumental to implementing the digital countryside and rural revitalization strategies. Recognizing the importance of e-commerce as an application of digital technologies, the Chinese government has launched a host of policy initiative to develop rural e-commerce[3]. In the *Opinions on Comprehensively Deepening Rural Reforms and Expediting Agricultural Modernization*, designated as the "*Central No.1 Document*" of 2014, the Chinese government has pledged to enhance the rural logistics service system, improve distribution infrastructure and ICT applications for the farm produce wholesale market, and promote e-commerce in rural areas. In 2014, the Ministry of Finance and the Ministry of Commerce jointly launched a comprehensive demonstration work of promoting e-commerce to enter rural areas (hereinafter named "the work" for short), which began by fostering demonstration counties for rural e-commerce. The work aims to achieve ground-breaking progress in the e-commerce policy system, reduce e-commerce logistics costs, and modernize rural distribution.

In this context, many scholars have evaluated the effects of the work on the income and consumption of rural households. In terms of income, the work has expanded the sales channels of agricultural products (Zeng et al., 2016), increased the bargaining power and access to information of rural households (Zhou, 2020), boosted their per capita net income by 33% to 39% (Shimamoto et al., 2015; Li et al., 2021), and provided them with income-generating jobs and business opportunities (Yu and Cao, 2022). In terms of consumption, this policy initiative has expedited the development of regional e-commerce service stations and logistical infrastructure to increase market accessibility, reduce trade costs and promote consumption growth for rural households (Wang et al., 2022; Yuan et al., 2023). Most of the existing literature has discussed the income or consumption effects of the work for rural households from an efficiency perspective. However, little attention has been paid to the impact on the consumption disparity of rural households, that is, whether this policy initiative can promote social fairness. In the new era, the principal contradiction facing Chinese society has transformed into the one between the people's growing need for a better life and unbalanced and inadequate development. Exploring ways to narrow consumption disparity among rural households will help alleviate social contradictions, enhance the welfare of rural households, and facilitate the implementation of the rural revitalization strategy.

Existing research fails to fully elucidate the consumption disparity among rural households. Firstly, some scholars contend that household indebtedness influences consumption inequality, yet the indebtedness of rural households is relatively low due to the underdeveloped rural financial infrastructure and poor credit availability for rural households. Secondly, financial development affects consumption disparity (de Haan and Sturm, 2017), but the lack of financial knowledge, modest income and significant credit constraints of rural households make it difficult to unleash rural consumer demand through financial development. Thirdly, housing price has an impact on the consumption disparity among rural households, but the increase in house prices is more prevalent in urban areas and has a smaller impact on rural households (Liu and Chen, 2021). According to the "permanent income hypothesis", under the friction-free condition, consumers smooth their consumption at every point in their lifecycle based on their permanent income to maximize utility. According to this hypothesis, household consumption disparity stem from income disparities (Zhang and Han, 2022), and rural household consumption inequality will decrease with narrowing income disparities. However, the sufficient condition for

[3] *Promulgation of the Opinions on Comprehensively Deepening Rural Reforms and Expediting Agricultural Modernization by the CPC Central Committee and the State Council* (Full Text), https://www.moa.gov.cn/ztzl/yhwj2014/zywj/201401/t20140120_3742567.htm.

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such a hypothesis is the absence of friction, which cannot be fulfilled in the real world, and unequal consumption opportunities will also lead to consumption disparity among rural households. According to the extended theory of unequal opportunities, the determinants of household consumption include "effort" and "environment". While "effort" determines individual disposable income and other factors, "environment" refers to the external environment, geographical location and other factors for individual households, including local market size and external market accessibility. The geographical factor has aggravated information asymmetry in the countryside, and access to the consumer market is uneven among rural households due to endowment disparities. Thus, the consumption effects of "effort" and "environment" for rural households are magnified. In conclusion, the inequality of consumption opportunities due to local market size and external market accessibility has expanded consumption disparity among rural households. Will the work alleviate the consumption-inhibiting effect of the local market size and external market accessibility for rural households? Will it narrow their consumption disparity by reducing their income disparities? This paper aims to answer these questions.

This paper explores the effects of e-commerce to enter rural areas on the consumption disparity among rural households and has the following marginal contributions: First, this paper focuses on the policy effect of e-commerce to enter rural areas on the consumption disparity among rural households, broadening the existing research that mainly addresses the effects of this policy initiative on the consumption, income and business vibrancy of rural households. Revealing the policy effects on the consumption disparity among rural households, which to some extent reflect welfare disparities, will help alleviate our principal social contradiction and achieve common prosperity. Second, this paper examines how the work narrows the consumption disparity among rural households by distributing consumer goods to villages and farm produce to cities, thereby expanding the research on the mechanism of this policy initiative.

2. Theoretical Analysis and Research Hypothesis

The comprehensive demonstration work of promoting e-commerce to enter rural areas serves a wide array of policy priorities. These include developing electronic transactions, online shopping, online payment, and logistical distribution services, accelerating the ICT transformation of rural commercial outlets, and enhancing the last-mile delivery and pickup. These endeavors have linked rural households to the external market, broadened their consumer channels, and brought consumer goods to villages. E-commerce has transformed the work and lifestyles of farmers. On the one hand, it enables farmers to sell produce directly to cities. E-commerce platforms have connected farmers with the external market, allowing them to sell their produce to a larger number of customers and increase incomes. In 2022, China recorded a nationwide online retail sales volume of farm produce amounting to 531.38 billion yuan[4]. On the other hand, e-commerce provides an additional channel for farmers to purchase daily consumer goods and raw materials (Wang et al., 2022; Yuan et al., 2023). Evidently, the work may influence rural consumption either directly or indirectly via the sales of farm produce. In this paper, we will elaborate on how this policy initiative affects the consumption disparity among rural households by promoting the sales of consumer goods in the countryside and farm produce in cities.

2.1 Direct Influence: Consumer Goods to Villages

The work enhances consumption convenience by expanding consumption channels (Wang et al., 2022; Yuan et al., 2023), and the facilitation of consumption reduces the consumption disparity among rural households (Chen and Cheng, 2021). Therefore, the work may narrow the consumption disparity among rural households by facilitating consumption. The effects on the consumption disparity among

[4] *China E-commerce Report (2022)*, http://images.mofcom.gov.cn/dzsws/202306/20230609104929992.pdf.

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rural households can be attributed to local market size and external market accessibility.

In terms of local market size, China's retail industry is concentrated in large cities, with a low level of coverage in remote regions (Fan et al., 2018). Due to the modest market size, the countryside is often overlooked by retailers, who favor locations with great market potential and centrality. This has led to a limited coverage of supermarkets with few categories of consumer goods in the countryside. Low-spending rural households are less likely than their high-spending counterparts to reach the external market due to information asymmetry and a relatively low level of endowment, and their lack of access to the external market has suppressed consumer demand and left them with little choice other than goods of inferior quality (Zhang et al., 2020). The work increases consumer choice by connecting rural households to the external market of high-quality and cost-effective goods that are otherwise unavailable in the local market, thereby satisfying rural consumer demand and reducing the impact of information asymmetry on low-spending rural households. Moreover, e-commerce platforms have made it less likely for rural households to end up with shoddy products through due diligence of merchant qualifications and product quality (Liu, 2017; Wang et al., 2022). By increasing the product categories of smaller local markets and keeping shoddy goods out, the work can reduce the consumption-inhibiting effect of the limited local market for low-spending rural households and thereby narrow the consumption disparity among rural households. The smaller the size of the regional consumer market, the more this policy initiative will stimulate rural household consumption by introducing consumer goods to villages.

In terms of external market accessibility, the work has narrowed consumption disparity among rural households by enhancing fair access to consumption opportunities and reducing trade costs. According to Becker (1965), the limitation of time is the most fundamental constraint for consumers, who encounter diverse constraints in various circumstances. The work may reduce the consumption disparity among rural households by facilitating consumption for rural households in remote areas, alleviating their time constraints, and promoting equal consumption opportunities. Another factor is geographical location, which influences the trade costs of goods and services, a key factor in commodity pricing. In remote areas, not only are local commodities more expensive, but the product categories are also fewer due to high distribution costs (Fan et al., 2018; Handbury, 2021). Low-spending consumers are more sensitive to price, and price discrimination related to geographical location has suppressed their consumer demand, causing their welfare level to be affected by price (Song et al., 2020). In contrast, high-spending rural households can access other consumption channels at a lower cost, thereby widening consumption disparity among rural households. The work has linked rural households in remote areas with poor market accessibility to the external market through the online channel (Fan et al., 2018). Logistical infrastructure can break down trade barriers for rural households in remote areas to access the external market (Wang et al., 2022). Since low-spending rural households are more constrained by market accessibility, the work has a greater marginal impact on low-spending rural households by increasing external market accessibility, thereby unleashing their consumption demand and reducing consumption disparities.

In a nutshell, the work may narrow consumption disparity among rural households by linking them to the external market, alleviating the constraints of local market size and external market accessibility, and promoting equal consumption opportunities. Hence, we put forward our first research hypothesis:

H1: Promoting e-commerce to enter rural areas effectively alleviates the constraints of local market size and external market accessibility on rural household consumption by distributing consumer goods to villages, thereby narrowing the consumption disparity among rural households.

2.2 Indirect Influence: Selling Farm Produce to Cities

The work has an income growth effect on rural households, increasing the volume and profit of their farm produce sales (Tang et al., 2020; Qiu and Zhou, 2021), and such an effect is greater for rural households in the low-income group and residing in remote areas (Aker and Mbiti, 2010; Kuhn and

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Mansour, 2014). Consumption disparities among rural households can be narrowed by reducing income inequality (Xie and Me, 2013). Thus, the work may reduce rural household income inequality and consumption disparity by raising the income level of low-income rural households.

One concern is whether the work will broaden rural household income disparities due to the "elite capture" phenomenon in the countryside and thereby widen consumption disparities? The government undertakes both competitive and non-competitive projects for rural development. Competitive projects are implemented through public tendering and bid evaluation. They include culture and tourism, rural development, and affordable housing projects. In most cases, non-competitive projects are related to public services such as social protection, healthcare, and compulsory education in poor areas (Tang and Yu, 2021). In comparison, the former is prone to an "elite capture" phenomenon. According to its criteria for application for comprehensive demonstration counties, the work is a competitive project. Hence, this policy is likely to serve the rural "elite group" such as educated or wealthy households, thereby intensifying income and consumption inequalities. Judging from the existing research, however, very few scholars have detected the existence of an "elite capture" phenomenon for this policy initiative. In practice, one of this initiative's primary objectives is to improve logistical infrastructure and establish e-commerce service stations. It provides public goods of a certain inclusive nature rather than transfer payments to a specific group of recipients. For this reason, this policy initiative is impervious to the "elite capture" phenomenon.

The question is how does the work increase the incomes of rural households and through which sales mode? The agriculture market is an oligopolistic market where farmers sell their produce at prices lower than the wholesale level. By introducing e-commerce platforms, the work enables rural households to earn higher incomes by selling their products directly to the external market (Shimamoto et al., 2015). E-commerce platforms enhance the availability of information to rural households and address information asymmetry in rural areas, thereby increasing their bargaining power and the sales volume of their farm produce (Wang et al., 2022; Li et al., 2021). Additionally, this policy initiative is beneficial for building a modern commodity distribution system in rural areas through the development of logistical infrastructure to enable rural households to sell farm produce online (Zhou, 2020; Wang and Lyu, 2021). Considering that low-income rural households have less access to information (He and Zhu, 2019) and fewer sales channels, this initiative may raise the incomes of low-income rural households and reduce rural household income disparities.

As discussed above, the work will help raise incomes of rural households, but the effect is greater for low-income rural households and thus may narrow consumption disparity among rural households by reducing their income disparities. Hence, the following hypothesis is put forth:

H2: Promoting e-commerce to enter rural areas narrows the consumption disparity among rural households by distributing farm produce to cities and thereby raising their incomes and reducing income inequality.

Our research approach is illustrated in Figure 1.

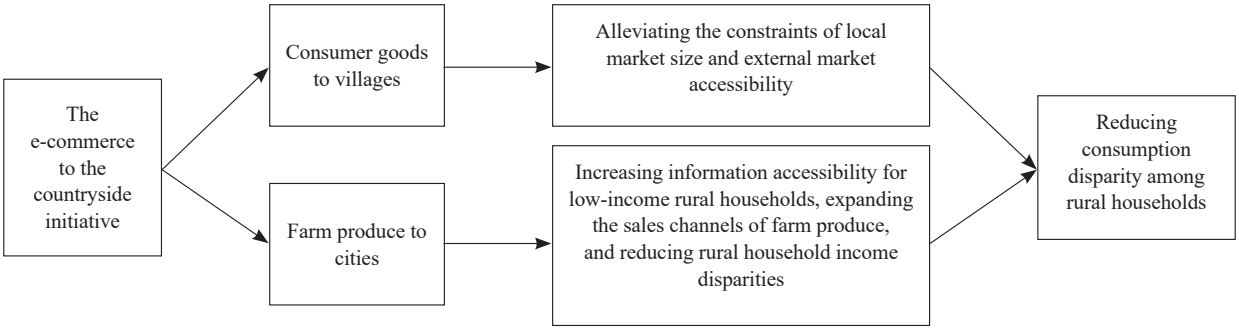

Figure 1: Research Approach

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3. Data Source and Variable Selection

3.1 Data Source

This paper utilizes microscopic survey data from the CFPS conducted by the Social Science Survey Center of Peking University. The CFPS gathers socio-economic information such as household consumption and income, as well as demographic information like family size, the educational attainment and age of family members. Since 2010, the Social Science Survey Center of Peking University has been organizing the survey once every two years, and the latest publicly available data is updated until 2020. In the survey data of 2010, questions related to "agricultural income" were inconsistent with those in the survey data of 2014, 2016, 2018, and 2020. Meanwhile, online shopping information was not included in the survey data of 2010, 2012, and 2020. Therefore, we adopt the survey data of 2014, 2016, 2018, and 2020 as our primary samples and employ the data of 2014, 2016, and 2018 for the partial mechanism test. Since the implementation of the work in 2014, the Ministry of Commerce has published a list of demonstration counties for e-commerce to the countryside each year. Between 2014 and 2019, this policy initiative was implemented in 56, 200, 240, 260, 260, and 215 counties (cities and districts) ("county-level jurisdictions"), respectively, all of which were demonstration counties for e-commerce to the countryside.

In this paper, we match the CFPS data with the list of demonstration counties for e-commerce to the countryside. After excluding communities or villages with a sample size smaller than 15 and retaining the samples of rural households, we have obtained 14,857 research samples. Among them, 3,232 households were surveyed twice, 1,927 households were surveyed three times, and 1,461 rural households were surveyed four times. Those samples were collected from 124 county-level jurisdictions, 57 of which were demonstration counties for e-commerce to the countryside.

3.2 Variable Explanations

3.2.1 Explained variable

Referring to Yang et al. (2022), this paper utilizes the Kakwani index (Kakwani, 1984) to measure the relative deprivation index of rural household consumption as the proxy variable for rural consumption disparities. This index will assist in exploring how the work influences consumption inequality among rural households. It also controls for the fixed effect of household in the regression model to account for time-invariant factors such as consumer behavior and regional culture, thereby reducing the model's estimation bias. Compared with the traditional consumption Yizhaki index, the consumption Kakwani index considers the impact of intra-group mean values. It compares sample rural households with their intra-group counterparts who have a higher level of consumption to measure consumption disparities. In this paper, we designate rural households residing in the same community or village as the same group, and the equation for calculating the Kakwani index RD_i for rural household consumption is:

$$RD_i=\frac{1}{n\mu_c}\sum_{i=j+1}^{n}\left(c_i-c_j\right)=\gamma_{cj}^{+}\left[\frac{\mu_{cj}^{+}-c_j}{\mu_c}\right] \tag{1}$$

In equation (1), n is the sample size of a group; μ_c is the mean consumption level of all households in the group; c_i is the consumption level of household i in the group; c_j is the consumption level of household j in the group; γ_{cj}^{+} is the proportion of households with a level of consumption above c_j to the total number of households in the group; and μ_{cj}^{+} is the mean consumption level of intra-group households above c_j.

3.2.2 Core explanatory variable

In this paper, we employ the implementation status of the work as the core explanatory variable. If a rural household resides in a demonstration county for e-commerce to the countryside in the current and subsequent years, the implementation status is assigned a value of 1; otherwise, the value is 0.

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3.2.3 Controlled variables

Referring to the existing research (Yang et al., 2022; Li and Zang, 2022), we have controlled for the income, total assets, family size, and child and elderly dependency ratios of rural households, as well as the educational attainment, gender, age and its square term, marital status and health conditions of household heads. In addition, we have controlled for the fixed effects of family, year and poor county.

3.2.4 Mechanistic variables

We measure the online consumption ratio and volume through the proportion of online consumption to the total consumption of rural households and the logarithm of rural household online consumption. They act as mechanistic variables to examine whether the work has impacted consumption disparity among rural households by distributing consumer goods to villages. Based on the analysis in the previous section, local market size and external market accessibility influence the distribution of consumer goods to villages. Therefore, we employ Harris's (1954) market potential index as the proxy variable of local market size and designate the travel time to the county seat as the proxy variable of external market accessibility. Since the CFPS of 2020 does not include household online consumption, we test the channels through which consumer goods enter villages using the CFPS data of 2014, 2016, and 2018 . The market potential index MP_m is computed using the following equation:

$$MP_m=\sum_{m\neq n}\frac{Pop_m}{d_{mn}}+\frac{2}{3}\sqrt{\frac{area_m}{\pi}} \quad (2)$$

In equation (2), Pop_m is the registered population of the county m prior to policy implementation (2013); d_{mn} is the spherical distance between county m and county n; $area_m$ is the area of county m; π is the circumference ratio. We divide rural households into the small-market and large-market groups based on the median value of the market potential index for the county-level jurisdictions where the rural households reside. A higher market potential index indicates a larger local market. Travel time to the county seat refers to the time it takes to travel from a local community or village to the county seat or urban district by daily modes of transportation such as on foot, by bus, train, or bicycle (in hours). According to the median value of this variable, we divide rural households into low-accessibility and high-accessibility groups. A longer travel time to the county seat implies lower accessibility to the external market.

We employ the ratio and volume of agricultural income as the mechanistic variables to examine whether the work affects consumption disparity among rural households through the sales channel of farm produce in cities. The ratio of agricultural income is the proportion of agricultural income to the total income of rural households over the past year, and agricultural income is in the logarithm of the income of rural households from agriculture over the past year.

3.3 Descriptive Statistics of Variables

Table 1 presents the descriptive statistics of the main variables in this paper. The mean value of the relative deprivation index, which serves as the explained variable, is 0.458. This is close to the overall urban-rural household consumption disparity estimated by Li and Zhang (2022) and slightly higher than the urban household consumption disparity estimated by Song et al. (2022). Obviously, there is a significant consumption disparity among rural households.

Among the controlled variables, the average household income amounts to 50,717 yuan. The average size of rural households is 4.133 persons. Each household supports 0.120 children aged below 15 and 0.240 elderly persons aged above 60. The average educational length of household heads is 6.110 years, and the average age of household heads is 52.776 years. 58.5% of household heads are male, and 87.2% of household heads are married. The average health status of household heads is 3.189, indicating a generally good health condition.

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Table 1: Variable Definitions and Descriptive Statistics

Variable	Variable Definitions	Observations	Mean Value	Standard Deviation	Min.	Max.
Relative consumption deprivation index	Rural household Kakwani index	14,857	0.458	0.241	0	4.633
Implementation status of the e-commerce to enter rural areas	The country (city or district) where a rural household resides is a demonstration county for the work in the current year and following years: Yes=1, No=0	14,857	0.286	0.452	0	1
Rural household income	Total income of the rural household over the past year (yuan)	14,857	50,717	130,951	85	11,400,000
Total assets of rural households	Total assets and liabilities of the rural household (yuan)	14,857	292,251	811,892	0	50,300,000
Family size	Number of family members in the rural household (persons)	14,857	4.133	1.990	1	21
Child dependency ratio	Proportion of family members aged below 15 in the rural household	14,857	0.120	0.161	0	0.8
Elderly dependency ratio	Proportion of family members aged above 60 in the rural household	14,857	0.240	0.332	0	1
Educational length of household head	Educational length of household head (years)	14,857	6.110	4.193	0	19
Gender of household head	Whether household head is male: Yes=1, No=0	14,857	0.585	0.493	0	1
Age of household head	Age of the household head (years)	14,857	52.776	13.005	16	91
Square term of age of household head	Age of the household head squared/100	14,857	29.544	13.753	2.560	82.810
Marital status of household head	Marital status of the household head: Yes=1, No=0	14,857	0.872	0.334	0	1
Health status of household head	Self-assessed health level of the household head: Unhealthy = 5, Fair = 4, Relatively healthy = 3, Very healthy = 2, Extremely healthy = 1	14,857	3.189	1.283	1	5
Online shopping consumption ratio	Proportion of online shopping consumption to total consumption of the rural household	11,043	0.048	0.171	0	1
Online shopping consumption volume	Online shopping consumption of the rural household (yuan)	11,043	261.607	9,633.815	0	1,000,000
Market potential index	Harris's (1954) market potential index for measuring market size	8,369	0.125	0.026	0.057	0.178
Travel time to county seat	Travel time between the community or village of the rural household and the county seat or urban district (hours)	10,129	4.219	10.094	0.100	75
Agricultural income ratio	Proportion of agricultural income to total income of the rural household over the past year	13,908	0.150	0.222	0	0.889
Agricultural income	Agricultural income of the rural household over the past year (yuan)	9,224	11,946.243	27,844.339	0	900,000

Note: In the subsequent regression analysis, we adopt the logarithms of the income, total assets, online shopping consumption and agricultural income of rural households.

3.4 Econometric Model Specification

The work is implemented on a gradual basis. Referring to Beck et al. (2010), therefore, we specify the following staggered difference-in-indifferences (DID) model:

$$RD_{kvt}=\beta_0+\beta_1 did_{kv,t-1}+[X_{kvt}\times f(t)]'\eta+d_v+d_t+d_l+\varepsilon_{kvt} \quad (3)$$

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In equation (3), RD_{kvt} is the relative consumption deprivation index of rural household v in county k during period t. $did_{kv,t-1}$ is the implementation status of the e-commerce to enter rural areas. Since it takes time for this initiative to create an impact, our core explanatory variable adopts a one phase lag of its implementation status. β_1 is the estimated coefficient of the core explanatory coefficient for measuring the policy initiative's impact on the consumption disparity among rural households. X_{kvt} is the controlled variables of rural household and household head. η is the estimated coefficient of the controlled variables. In order to capture the heterogeneous impact of observable variables on the explained variable, we introduce an interaction term $f(t)$ between all the controlled variables and the cubic polynomial of temporal trend referring to Yu and Ma (2022). In addition, we have also controlled for the fixed effect of household d_v and fixed effect of year d_t to mitigate the impact of time-invariant household characteristics and macro-economic factors on the consumption disparity among rural households. The work has a certain poverty-reducing effect (Wang et al., 2021). In determining the name list of demonstration counties for promoting e-commerce to enter rural areas, the government would prioritize consideration of poor counties[5], where consumption disparity among rural households is relatively wide[6]. Therefore, whether the county-level jurisdiction where a rural household resides is a poor county may influence if the county-level jurisdiction is recognized as a demonstration county for e-commerce to the countryside and the degree of county-wide consumption disparity among rural households. Hence, we have controlled for the fixed effect of poor county d_l. ε_{kvt} is stochastic disturbance term. In this paper, the standard deviations are clustered at the county-year level.

4. Analysis of Empirical Results

4.1 Baseline Regression

Table 2 presents the estimated results of the baseline regression. The controlled variables in equation 1 are not cross-multiplied with the cubic polynomial $f(t)$ of temporal trend. According to the

Table 2: Baseline Regression Result of the Impact of E-commerce to Enter Rural Areas on Rural Household Consumption disparity

Variable	Relative consumption deprivation index			
	Equation 1		Equation 2	
	Estimated coefficient	Standard error	Estimated coefficient	Standard error
Implementation status of the e-commerce to enter rural areas	−0.023*	0.012	−0.026**	0.012
Income of rural household	−0.035***	0.003		
Total assets of rural household	−0.021***	0.003		
Family size of rural households	0.036***	0.003		
Child dependency ratio	0.039*	0.022		
Elderly dependency ratio	0.010	0.016		
Educational length of household head	−0.001	0.001		
Gender of household head	−0.023***	0.006		
Age of household head	0.003***	0.000		
Square term of age of household head	0.007*	0.000		
Marital status of household head	0.019*	0.010		

[5] By 2020, the work has covered all the 832 poor counties (source: China's Comprehensive Demonstration Work of Promoting E-Commerce to Enter Rural Areas Achieves Full Coverage of the 832 Poor Counties, https://www.gov.cn/xinwen/2020-10/26/content_5554808.htm).

[6] Among our samples, the mean value of the relative consumption deprivation index for rural households in poor counties is 0.47, and that for rural households in non-poor counties is 0.44. The inter-group difference is significant at the 1% level.

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Table 2 Continued

Variable	Relative consumption deprivation index			
	Equation 1		Equation 2	
	Estimated coefficient	Standard error	Estimated coefficient	Standard error
Health status of household head	0.001	0.002		
Income of rural household × Cubic polynomial of temporal trend			−0.071***	0.021
Total assets of rural household × Cubic polynomial of temporal trend			−0.006*	0.003
Family size of rural household × Cubic polynomial of temporal trend			0.001	0.007
Child support ratio × Cubic polynomial of temporal trend			0.111***	0.017
Elderly support ratio × Cubic polynomial of temporal trend			0.015**	0.006
Educational length of household head × Cubic polynomial of temporal trend			−0.026**	0.012
Gender of household head × Cubic polynomial of temporal trend			−0.071***	0.021
Age of household head × Cubic polynomial of temporal trend			−0.006*	0.003
Square term of age of household head × Cubic polynomial of temporal trend			0.001	0.007
Marital status of household head × Cubic polynomial of temporal trend			0.111***	0.017
Health condition of household head × Cubic polynomial of temporal trend			0.015**	0.006
Fixed effect of poor county	Controlled		Controlled	
Fixed effect of household	Controlled		Controlled	
Fixed effect of year	Controlled		Controlled	
Observations	14,857		14,857	
Intra-group R^2	0.057		0.031	

Note: (1) ***, ** and * indicate significance at 1%, 5% and 10% levels; (2) standard errors are clustered at the county-year level, same below.

estimated results of equation 1, the implementation of the work has an impact of -0.023 on the relative consumption deprivation index of rural households, with the core explanatory variable being significant at the 10% statistical level. Equation 2 shows the estimated results based on equation 3. The work has significantly reduced the consumption disparity among rural households, with the core explanatory variable significant at the 5% level, and a coefficient of -0.026. These results suggest that this policy initiative has reduced the consumption disparity among rural households, partially supporting hypothesis H1.

4.2 Robustness Test

4.2.1 Parallel trend test

In order to obtain a consistent estimator of the average treatment effect of the policy using the DID method, the experimental group and the control group need to satisfy the parallel trend hypothesis. In this section, we will conduct a parallel trend test using the method developed by Callaway and Sant'Anna (2021) for estimating the heterogeneous average treatment effect (HATE). Figure 2 shows the estimated coefficients of the average treatment effect of the implementation of the work at various relative time points, as well as their 95% confidence intervals. Before the policy shock, there was no significant difference in the relative deprivation index between the experimental group and the control group. After the policy implementation, there was a significant reduction in the rural consumption disparity.

4.2.2 Estimation using the instrumental variable (IV) method

We have controlled for household and household head variables that affect the relative consumption deprivation index for rural households, as well as the fixed effects of poor county, household, and year.

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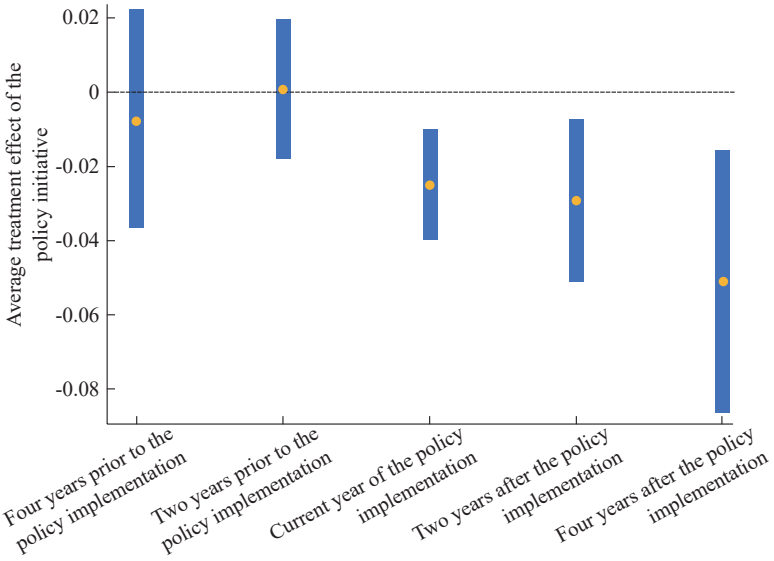

Figure 2: Result of the Parallel Trend Test

Note: The horizontal axis represents the implementation time point of promoting e-commerce to enter rural areas. The orange dots indicate the estimated coefficients of the average treatment effect of policy implementation, and the blue area represents the 95% confidence interval of the estimated coefficient.

However, there remains a risk of missing time-varying variables at the household or county level, which may cause the estimated coefficient of the core explanatory variable to be inconsistent. To mitigate this estimation bias arising from endogeneity, we use the number of post and telecom bureaus per million inhabitants in the municipality of the county-level jurisdiction where rural households resided at the end of 1984 ("number of post and telecom bureaus per million inhabitants") as an instrumental variable. This instrument needs to satisfy both relevance and exclusivity requirements. In terms of relevance, Internet infrastructure is essential for e-commerce development. During the era of dial-up Internet access, this infrastructure was primarily constructed by local post and telecom bureaus. Therefore, regions with more post and telecom bureaus had better Internet infrastructure, indicating a positive correlation between the instrumental variable and the endogenous variable. Regarding exclusivity, the number of post and telecom bureaus reflects the level of political attention from the central government. The Chinese government tends to base decisions about establishing or closing post and telecom bureaus on the political significance of the locality, rather than economic factors (Yuan et al., 2023). Hence, this instrumental variable also satisfies the exclusivity requirement. To further address the auto-selection effect and enhance the precision of the core explanatory variable's estimation, we have controlled for Internet penetration, mean household income at the county level, and mean total assets of county-level households. Internet penetration is defined as the proportion of broadband access users to the total number of local households. The mean income and total assets of county-level households are the average values of household income and total assets at the county level. The instrumental variable is time-invariant. Following Zhang et al. (2020), we cross-multiply the instrumental variable with the "probability for other counties across the country to become demonstration counties for e-commerce to the countryside" (cross-product term).

Table 3 presents the estimated results of the instrumental variable method. Equation 1 shows the first-stage estimation, indicating that the instrumental variable has a significantly positive effect on the core explanatory variable. Equations 2 and 3 provide the second-stage estimation results. Equation 2 does not control for Internet penetration, mean income, or mean total assets of county-level households.

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equation 3 includes controls for the interaction term between these three variables and the cubic polynomial of the temporal trend. In both Equations 2 and 3, the Kleibergen-Paap rk LM statistic and the Kleibergen-Paap rk Wald F statistic indicate that the instrumental variable selected is not weak. Based on the estimated results of equations 2 and 3, the work has significantly reduced the relative consumption deprivation index for rural households, suggesting that our baseline regression conclusions are robust.

Table 3: Estimated Impact of the E-Commerce to Enter Rural Areas on Rural Household Consumption disparity Using the Instrumental Variable Method

Variable	Implementation status of the e-commerce to enter rural areas		Relative consumption deprivation index			
	Equation 1		Equation 2		Equation 3	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Implementation of promoting e-commerce to enter rural areas			−0.092**	0.040	−0.106**	0.042
Cross-product term	0.286***	0.056				
Internet penetration × Cubic polynomial of temporal trend					0.022*	0.012
Mean county-level household income × Cubic polynomial of temporal trend					0.019	0.014
Mean total assets of county-level households × Cubic polynomial of temporal trend					0.011	0.014
Control variable	Controlled		Controlled		Controlled	
Fixed effect of poor county	Controlled		Controlled		Controlled	
Fixed effect of household	Controlled		Controlled		Controlled	
Fixed effect of year	Controlled		Controlled		Controlled	
Kleibergen-Paap rk LM statistic			25.016		24.827	
Kleibergen-Paap rk Wald F statistic			26.349		25.354	
Observations	10,289		10,289		10,289	

Note: Control variables are the same as those in equation 2 of Table 2, same below.

4.2.3 Use of community-level data

If the baseline regression conclusions are robust, the estimated results based on community-level data should generally be consistent with the baseline regression. Referring to Liu and Chen (2021), we employ community-level data to calculate the consumption Gini coefficient and the consumption Theil index of rural households for measuring consumption disparity among rural households. The community-level mean values of the aforementioned controlled variables are adopted. The Gini coefficient is calculated based on the area ratio of the Lorenz curve, and the Theil index is calculated based on the concept of information entropy.

Estimated results based on community-level data are presented in Table 4. Equations 1 and 4 present estimated results from the panel fixed-effect model, while equations 2, 3, 5, and 6 present estimated results based on the instrumental variable (IV) method. According to the results of equations 1 through 3, the work has significantly reduced the consumption Gini coefficient of rural households. Similarly, the results of equations 4 through 6 indicate a significant reduction in the consumption Theil index. In summary, the e-commerce to enter rural areas has notably decreased the consumption disparity among rural households. The estimated results based on community-level data are generally consistent with the baseline regression, confirming the robustness of the research conclusions.

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Table 4: Estimated Impact of the E-Commerce to Enter Rural Areas on Rural Household Consumption disparity Based on Community-Level Data

Variable	Equation 1	Equation 2	Equation 3	Equation 4	Equation 5	Equation 6
	Consumption Gini coefficient	Implementation status of promoting e-commerce to enter rural areas	Consumption Gini coefficient	Consumption Theil coefficient	Implementation status of promoting e-commerce to enter rural areas	Implementation status of promoting e-commerce to enter rural areas
	Panel fixed-effect model	IV method (first stage)	IV method (second stage)	Panel fixed-effect model	IV method (first stage)	IV method (second stage)
Implementation status of promoting e-commerce to enter rural areas	−0.026* (0.015)		−0.104** (0.053)	−0.050* (0.027)		−0.253** (0.107)
Cross-product term		0.252*** (0.072)			0.257*** (0.080)	
Control variable	Controlled		Controlled	Controlled		Controlled
Fixed effect of poor county	Controlled		Controlled	Controlled		Controlled
Fixed effect of community	Controlled		Controlled	Controlled		Controlled
Fixed effect of year	Controlled		Controlled	Controlled		Controlled
Kleibergen-Paap rk LM statistic			13.350			11.407
Kleibergen-Paap rk Wald F statistic			12.386			10.322
Observations	327		293	271		203
Intra-group R^2	0.041			0.068		

Table 5: Estimated Impact of the E-Commerce to Enter Rural Areas on the Rural Household Consumption disparity using the Robust Estimation Methods

Estimation Method	Coefficient of the implementation status of promoting e-commerce to enter rural areas	Standard error of the implementation status of promoting e-commerce to enter rural areas
Estimation method for heterogeneous average treatment effect (HATE)	−0.019**	0.009
Synthetic DID method	−0.035***	0.011
Estimation method based on interpolation	−0.035***	0.010

4.2.4 Use of robust estimation methods

In this section, we replace the staggered DID method with the estimation method for heterogeneous average treatment effect (HATE) developed by Callaway and Sant'Anna (2021), the synthetic DID method by Arkhangelsky et al. (2021), and the estimation method based on interpolation by Borusyak et al. (2024) to test whether the replacement of the estimation method for the average treatment effects will affect our conclusions. According to the estimated results in Table 5, the coefficients for the implementation status of the work are -0.019, -0.035, and -0.035 after those estimation methods are adopted respectively, and the core explanatory variable is significant at least at the 5% statistical level. These results are generally consistent with the baseline regression, demonstrating the robustness of our baseline regression conclusions.

4.2.5 Substitution of the explained variable

In this section, we modify the cohorts for comparison when computing the relative consumption deprivation index. In the baseline regression, we compared the consumption levels of rural households

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within the same community. Here, we replace the comparison group with other rural households of the same county-level jurisdiction to recalculate the relative consumption deprivation index and change the explained variable for another round of regression. The regression results are presented in equation 1 of Table 6. Based on the estimated outcome, the implementation status of the work has a significantly negative effect on the relative consumption deprivation index for the comparison group of other rural households within the county-level jurisdiction. This implies the robustness of the baseline regression conclusions.

4.2.6 Control for the impact of other policy initiatives

In 2014, the State Council launched the "Broadband Countryside"[7] and "Broadband China"[8] pilot programs to promote Internet development at the local level. These policy initiatives have facilitated the development of Internet infrastructure and enhanced the convenience of household consumption, creating conditions for the reduction of consumption disparity among rural households. To eliminate the influence of concurrent Internet infrastructure pilot programs on the rural consumption disparity, we have controlled for the impact of the "Broadband Countryside" and "Broadband China" pilot programs. If the county-level jurisdiction where a rural household is located in the current and subsequent years is a pilot county for the "Broadband Countryside", the implementation status of "Broadband Countryside" is assigned a value of 1; otherwise, it is assigned a value of 0. If the local county-level jurisdiction where the rural household is situated is in a pilot city for the "Broadband China" strategy during the policy implementation stage, the implementation status of the "Broadband China" pilot program is 1; otherwise, it is 0. The estimated results are presented in equations 2 and 3 of Table 6. According to the results, the implementation status of the work has still significantly decreased the relative consumption deprivation index of rural households after controlling for the impact of other pilot policy programs for Internet infrastructure development. The estimated results are generally consistent with the baseline regression results, demonstrating the robustness of our conclusions.

4.2.7 Control for the impact of provincial capital cities and the county trend term

With a more advanced level of economic development, provincial capital cities might offer greater support to their county-level jurisdictions. Taking this into account, we have controlled for the interaction term between provincial capital city and the temporal trend term. If rural households are located in a provincial capital city, the variable for provincial capital city is assigned a value of 1; otherwise, the variable of provincial capital city is assigned a value of 0. The estimated results are presented in equation 4 of Table 6. Based on the estimated results, the implementation of the work still has reduced consumption disparity among rural households after controlling for the interaction term between provincial capital city and the temporal trend term.

Within the sample interval, county-level governments might enact other pro-poor policies that could influence the estimation of the average treatment effect of the e-commerce to enter rural areas. In this section, we have further controlled for the interaction term between the dummy variable of county and the temporal trend term ("county trend term") to absorb the impact of such county-level time-variant policy factors. Based on the estimated results of equation 5 of Table 6, the implementation status of the work still has a significantly negative impact on the relative consumption deprivation index of rural households, demonstrating the robustness of the baseline regression results.

[7] Notice on the Implementation of the "Broadband Countryside" Pilot Project (Phase I), https://www.gov.cn/xinwen/2014-06/18/content_2703143.htm.

[8] Notice of the State Council on Issuing the "Broadband China" Strategy and Implementation Plan, https://www.gov.cn/zhengce/content/2013-08/16/content_5060.htm.

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Table 6: Estimated Results of Other Robustness Tests for the Impact of the work on Rural Household Consumption disparity

Variable	Relative consumption deprivation index				
	Substitution of explained variable	Control for the impact of other policy initiatives		Control for the impact of provincial capital cities	Control for the impact of county trend term
	Equation 1	Equation 2	Equation 3	Equation 4	Equation 5
Implementation status of promoting e-commerce to enter rural areas	−0.029** (0.014)	−0.029** (0.012)	−0.027** (0.012)	−0.030** (0.012)	−0.024* (0.014)
Pilot status of the "broadband countryside" program		0.058* (0.032)			
Pilot status of the "broadband China" program			0.040** (0.017)		
Provincial capital city × Temporal trend term				Controlled	
Controlled variables	Controlled	Controlled	Controlled	Controlled	Controlled
Fixed effect of poor county	Controlled	Controlled	Controlled	Controlled	
Fixed effect of household	Controlled	Controlled	Controlled	Controlled	Controlled
Fixed effect of year	Controlled	Controlled	Controlled	Controlled	Controlled
County trend term					Controlled
Observations	12770	14831	14429	14857	14856
Intragroup R^2	0.034	0.032	0.035	0.031	0.029

5. Further Tests

5.1 Mechanistic Analysis

5.1.1 Direct effect: Consumer goods to villages

In this section, we will initially test if the implementation of e-commerce to enter rural areas could influence the consumption disparity among rural households through the distribution channel of consumer goods to villages. Subsequently, another test will be carried out to explore whether this policy initiative can alleviate the restrictions of local market size and limited external market accessibility for rural household consumption, thereby narrowing the consumption disparity among rural households. The online consumption ratio and volume serve as mechanistic variables for testing the channel through which consumer goods enter villages.

Firstly, Table 7 presents the estimated effect of the work on the online consumption ratio and volume, as well as the estimated influence of the online consumption ratio and volume on the consumption disparity among rural households. Due to its truncation issue, when analyzing the impact of the work on the online consumption ratio and volume, the online consumption of rural households is estimated using the panel Tobit model. The panel fixed effect model is utilized in estimating the effect of the online consumption ratio and volume on the relative consumption deprivation index of rural households. The estimated outcomes of equations 1 and 2 imply that the implementation of the work has augmented both the online consumption volume and ratio of rural households.

Based on the median values of the online consumption ratio and volume, we further divide the sample rural households into the low-online-consumption-ratio group, the high-online-consumption-ratio group, the low-online-consumption-volume group, and the high-online-consumption-volume group to test the heterogeneous impact of the work on the consumption disparity among rural households. The estimated results of equations 3 and 4 indicate that the work has significantly narrowed the consumption disparity among rural households in the high-online-consumption-ratio group. According to the estimated

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Table 7: Estimated Results of Mechanistic Analysis of the Impact of E-Commerce to Enter Rural Areas on Rural Household Consumption disparity: Distribution of Consumer Goods to Villages

Variable	Panel Tobit model		Panel fixed effect model			
	Online consumption ratio	Online consumption volume	Relative consumption deprivation index			
	Equation 1	Equation 2	Equation 3	Equation 4	Equation 5	Equation 6
	Total samples	Total samples	Low-online-consumption-ratio group	High-online-consumption-ratio group	Low-online-consumption-volume group	High-online-consumption-volume group
Implementation status of promoting e-commerce to enter rural areas	0.143** (0.061)	1.503** (0.625)	−0.003 (0.014)	−0.039** (0.018)	−0.012 (0.015)	−0.028* (0.015)
Controlled variables	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Fixed effect of poor county	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Fixed effect of household			Controlled	Controlled	Controlled	Controlled
Fixed effect of year	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Fixed effect of county	Controlled	Controlled				
Observations	11,773	12,162	5,426	4,822	5,249	4,999
Pseudo R^2 or intra-group R^2	0.393	0.241	0.143	0.162	0.138	0.167

Note: Data employed for regression are CFPS data of 2014, 2016 and 2018, same below.

results of equations 5 and 6, the work has significantly reduced the consumption disparity among rural households in the high-online-consumption-volume group. As can be inferred from the estimated results of Table 7, the work may decrease the consumption disparity among rural households by facilitating the distribution of consumer goods to villages.

Secondly, we examine how e-commerce to enter rural areas could impact the consumption disparity among rural households through local market size. Based on the median value of the market potential index for the county-level jurisdiction, we categorize rural households in county-level jurisdictions with market potential index greater than or equal to the median value as the large-market-size group, and those in county-level jurisdictions smaller than the median value as the low-market-size group. Simultaneously, we further conduct intra-group classification of rural households with varying market potentials based on their household consumption volume. Rural households with consumption volume lower than the median level are classified as the low-consumption group, and those with consumption volume greater than the median level are categorized as the high-consumption group. The estimated results based on the Tobit model are presented in Table 8. According to the estimated results of Table 8, the implementation status of the work has significantly positive effects on both the online consumption volume and ratio of low-consumption rural households in a small-market-size region. This suggests that the work has expanded consumption channels for low-consumption rural households in small-market-size regions. By facilitating the distribution of consumer goods to villages, this policy initiative has unleashed the consumer demand of those rural households, mitigated the consumption-inhibiting effect of a small market size, and thereby narrowed the consumption disparity among rural households. Based on the above analysis, the e-commerce to enter rural areas has reduced the consumption disparity among rural households by alleviating the consumption-inhibiting effect of a small market size on low-consumption rural households. Hence, hypothesis H1 is partially verified.

Lastly, we designate travel time to the county seat as a proxy variable of external market accessibility to test whether the work has influenced the consumption disparity among rural households by affecting external market accessibility. In this section, sample rural households are grouped based

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Table 8: Estimated Results of the Mechanistic Analysis of the Impact of E-Commerce to Enter Rural Areas on Rural Household Consumption disparity: Local Market Size

Variable	Online consumption ratio				Online consumption volume			
	Small-market group		Large-market group		Small-market group		Large-market group	
	Equation 1	Equation 2	Equation 3	Equation 4	Equation 5	Equation 6	Equation 7	Equation 8
	Low-consumption group	High-consumption group	Low-consumption group	High-consumption group	Low-consumption group	High-consumption group	Low-consumption group	High-consumption group
Implementation status of promoting e-commerce to enter rural areas	0.759*** (0.209)	−0.015 (0.086)	−0.154 (0.124)	0.004 (0.013)	7.325*** (1.970)	0.108 (0.963)	−1.549 (1.278)	0.027 (0.136)
Controlled variables	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Fixed effect of poor county	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Fixed effect of year	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
County-level fixed effect	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Observations	2,723	2,071	2,262	2,149	2,721	2,054	2,262	2,137
Pseudo R^2	0.336	0.363	0.533	−0.737	0.232	0.216	0.359	0.110

on the median travel time to the county seat. Those residing in places with travel time to the county seat below the median level are classified into the high-external-market-accessibility group, and those whose travel time to the county seat is greater than or equal to the median level are divided into the low-external-market-accessibility group. Based on consumption volume, we further conduct intra-group classification of rural households with short and long travel times. Those with consumption spending smaller than the intra-group median rural household consumption are divided into the low-consumption group, and those with consumption spending greater than or equal to the median level are divided into the high-consumption group. The estimated results are presented in Table 9, and the model used for estimation is the panel Tobit model. The estimated results in Table 9 indicate that the implementation status of the work has a significantly positive effect on both the online consumption ratio and volume of the long-travel-time group of rural households, that is, rural households in regions with low external market accessibility. Among rural households with low external market accessibility, the work has

Table 9: Estimated Results of the Mechanistic Analysis of the Impact of E-Commerce to Enter Rural Areas on Rural Household Consumption disparity: External Market Accessibility

Variable	Online consumption ratio				Online consumption volume			
	High-external-market-accessibility group		Low-external-market-accessibility group		High-external-market-accessibility group		Low-external-market-accessibility group	
	Equation 1	Equation 2	Equation 3	Equation 4	Equation 5	Equation 6	Equation 7	Equation 8
	Low consumption group	High consumption group	Low consumption group	High consumption group	Low consumption group	High consumption group	Low consumption group	High consumption group
Implementation status of promoting e-commerce to enter rural areas	0.160 (0.153)	0.053 (0.090)	0.427*** (0.159)	0.208** (0.098)	1.654 (1.448)	0.600 (0.984)	4.369*** (1.578)	2.586** (1.133)
Controlled variables	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Fixed effect of poor county	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Fixed effect of year	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
County-level fixed effect	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Observations	2,813	2,562	2,896	2,437	2,812	2,548	2,896	2,426
Pseudo R^2	0.499	0.414	0.460	0.434	0.342	0.237	0.309	0.256

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exerted a greater influence on low-consumption rural households. Therefore, the work may reduce the consumption disparity among rural households by increasing the consumption level of rural households, especially low-consumption ones, in low-external-market-accessibility regions. Based on the above analysis, the work has reduced trade costs in the countryside, alleviated the consumption-inhibiting effect of low external market accessibility for low-consumption rural households, and thereby narrowed the consumption disparity among rural households by constructing local logistical points and broadening rural household consumption channels. Hence, hypothesis H1 is verified.

5.1.2 Indirect effect: Distribution of farm produce to cities

In this section, we aim to test whether the work can influence the consumption disparity among rural households through the distribution of farm produce to cities, which is tested with farm income and farm income ratio as the mechanistic variables.

Table 10 presents the impact of the work on the agricultural income and agricultural income ratio of rural households. All equations are estimated using the panel fixed-effect model. The estimated results of equations 1 and 2 indicate that the work has increased the agricultural income and agricultural income ratio of rural households. We further group the sample rural households based on their median agricultural income. Specifically, rural households with incomes below the median income are divided into the low-income group, and those with incomes at or above the median income are classified into the high-income group. The estimated results of equations 3 and 4 suggest that the work has a significantly positive effect on the agricultural income ratio of rural households in the low-income group. The estimated results of equations 5 and 6 suggest that the work has raised the agricultural income of rural households in the low-income group. These results indicate that the work may increase the agricultural income of low-income rural households, alleviate income inequality among rural households, and thereby narrow their consumption disparity.

Table 10: Estimated Results of the Mechanistic Analysis of the Impact of E-Commerce to Enter Rural Areas on Rural Household Consumption disparity: Distribution of Farm Produce to Cities

Variable	Agricultural income ratio	Agricultural income	Agricultural income ratio		Agricultural income	
	Equation 1	Equation 2	Equation 3	Equation 4	Equation 5	Equation 6
	Total samples	Total samples	Low-income group	High-income group	Low-income group	High-income group
Implementation status of promoting e-commerce to enter rural areas	0.017** (0.009)	0.551*** (0.188)	0.029** (0.012)	0.013 (0.010)	0.752*** (0.270)	0.301 (0.217)
Control variable	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Fixed effect of poor county	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Fixed effect of household	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Fixed effect of year	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Observations	13,908	9,224	6,240	5,191	3,787	3,422
Intra-group R^2	0.013	0.033	0.019	0.011	0.043	0.032

5.2 Heterogeneity Analysis

5.2.1 Promoting e-commerce to enter rural areas and inclusive growth

According to the "center-periphery" development theory (Kakwani and Subbarao, 2007), the rapid growth of core regions often comes at the expense of slow or even negative growth in peripheral regions. In China, the rapid economic growth in the eastern region contrasts with the slower growth in

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the central and western regions. Compared to the eastern region, the central and western regions have less access to the external market, a smaller local market size, and lower per capita disposable income, which may result in an even greater consumption disparity among rural households. For this reason, we divide the sample rural households based on whether the county-level jurisdiction where they reside is located in the eastern region of China and whether it is a poor county to test if the work can narrow the consumption disparity between rural households in the central and western regions and in poor counties, as the basis for determining whether this policy initiative has inclusive growth characteristics.

According to the estimated results in equations 1 and 2 of Table 11, the work has a significantly negative impact on the relative consumption deprivation index of rural households in the central and western regions of China. That is, the work may significantly narrow the consumption disparity among rural households in the central and western regions, thereby reducing the overall consumption disparity among rural households. The estimated results of equations 3 and 4 indicate that the work has a significantly negative impact on the consumption disparity among rural households in poor counties. This implies that the policy initiative has a certain poverty-reducing effect and is conducive to narrowing the consumption disparity among rural households in less developed regions for the realization of common prosperity. Thus, the work is characterized by inclusive growth.

Table 11: Estimated Results for the Test of Inclusive Growth Characteristic of the E-Commerce to the Countryside Initiative

Variable	Equation 1	Equation 2	Equation 3	Equation 4
	Eastern region	Central and western regions	Non-poor counties	Poor counties
Implementation status of promoting e-commerce to enter rural areas	−0.004 (0.021)	−0.034** (0.015)	−0.009 (0.020)	−0.045* (0.023)
Controlled variables	Controlled	Controlled	Controlled	Controlled
Fixed effect of poor county	Controlled	Controlled	Controlled	Controlled
Fixed effect of household	Controlled	Controlled	Controlled	Controlled
Fixed effect of year	Controlled	Controlled	Controlled	Controlled
Observations	5,525	9,182	8,962	4,548
Intra-group R^2	0.036	0.032	0.033	0.040

5.2.2 Is e-commerce to enter rural areas subject to the "elite capture" phenomenon?

Severe information asymmetry in the rural areas results in insufficient targeting of pro-poor policies. The rural elite class can leverage their superior access to information to intercept poverty alleviation resources, giving rise to an "elite capture" phenomenon (He and Zhu, 2019). Under the comprehensive demonstration work of promoting e-commerce to enter rural areas, which has a certain nature of poverty alleviation, the interception of pro-poor resources by the rural elite class is likely to expand the consumption disparity among rural households, which is contrary to the policy intention.

Wealth accumulation is a relatively slow process for rural households. Unlike previous research that adopted income-based grouping (Yin et al., 2020), we have categorized sample rural households based on their household wealth level to avert estimation bias resulting from changes in income and consumption and to mitigate the influence of income volatility on our research conclusions. Referring to Dutta (2009) and Hu and Wang (2017), we have divided the sample rural households into groups based on their total assets. Those with total assets at or below the 33rd percentile is classified as the low-household-wealth group, those with total assets above the 33rd percentile and below the 66th percentile as the medium-household-wealth group, and those with total assets at or above the 66th percentile as the high-household-wealth group. According to the results of grouped estimation presented in Table 12,

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Table 12: Estimation Results for Testing the "Elite Capture" Phenomenon in the Implementation of the E-Commerce to the Countryside Initiative

Variable	Equation 1	Equation 2	Equation 3
	Low-household-wealth group	Medium-household-wealth group	High-household-wealth group
Implementation status of the promoting e-commerce to enter rural areas	−0.034* (0.018)	−0.033 (0.020)	−0.025 (0.017)
Controlled variables	Controlled	Controlled	Controlled
Fixed effect of poor county	Controlled	Controlled	Controlled
Fixed effect of household	Controlled	Controlled	Controlled
Fixed effect of year	Controlled	Controlled	Controlled
Observations	3,489	3,644	3,295
Intra-group R^2	0.042	0.019	0.030

the work has reduced the consumption disparity among rural households for the low-household-wealth group, while the impact is insignificant for the medium and high-household-wealth groups. This implies that the initiative has primarily benefited rural households in poorer economic circumstances and is less prone to the "elite capture" phenomenon.

6. Concluding Remarks and Policy Implications

China has achieved a great victory in eradicating absolute poverty and is endeavoring to implement the countryside revitalization strategy. In this context, the efforts to narrow the consumption disparity among rural households will enhance the overall welfare of rural households, promote common prosperity, raise rural consumption level, and foster domestic economic circulation. E-commerce to enter rural areas has linked rural households to the external market, removed barriers to commodity circulation, and reduced the consumption disparity among rural households.

Based on the data of 2014, 2016, 2018 and 2020 from the CFPS, this paper assesses the impact of e-commerce to enter rural areas on the consumption disparity among rural households. Our research indicates that the work has narrowed the consumption disparity among rural households, and this conclusion remains valid after considering endogeneity and conducting a series of robustness tests. The findings from our mechanistic analysis are twofold: First, the work has reduced the consumption disparity among rural households by alleviating the consumption-inhibiting effect caused by the small local market size and limited external market accessibility for rural households, and thereby unleashing their consumption demand. Second, another channel through which this policy initiative reduces the consumption disparity among rural households is the distribution of farm produce to cities, which may increase the income of low-income rural households and reduce their income inequality. Additionally, we have identified the inclusive growth nature of this policy initiative, which can reduce the consumption disparity among rural households who reside in poor counties and in the central and western regions. Such inclusive growth is not susceptible to the "elite capture" phenomenon.

Based on our research conclusions, we propose the following policy suggestions: Firstly, the government should intensify efforts to develop rural e-commerce service stations and logistical infrastructure. Greater support should be extended to rural e-commerce to utilize e-commerce platforms, thereby expanding consumption channels for rural households and reducing the consumption-inhibiting effect of information asymmetry. These measures will enhance consumption in rural areas and foster domestic economic circulation. Secondly, it is advisable for the government to establish a training system for rural households to develop skills to market commodities and farm produce on e-commerce platforms. Thirdly, the government should consider the heterogeneous policy impact on various social

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groups. Given the heterogeneous education and other endowments of rural households, the e-commerce development policy may not benefit low-endowment rural households and thereby may widen income and welfare disparities among rural households. When implementing e-commerce development policies, local governments must avoid a "one-size-fits-all" approach. Instead, they should formulate tailored policy solutions in light of the specific characteristics of rural households. This will support income growth for low-endowment rural households, reduce consumption disparities, and contribute to the achievement of common prosperity.

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